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Date: November 14, 2007 Name: Jasper W. Dockrey, Reg. 33,868 Signature: /Jasper W. Dockrey/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of:	Moriceau, et al.	
Appln. No.:	10/565,621	Examiner: Reema Patel
Filed:	July 25, 2006	Art Unit: 2812
For:	STACKED STRUCTURE AND PRODUCTION METHOD THEREOF	Confirmation No.: 2319
Attorney Docket No:	9905/37 (BIF116044US)	

SUBMISSION OF CERTIFIED ENGLISH TRANSLATION

Commissioner for Patents
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Alexandria, VA 22313-1450

Dear Sir:

Submitted herewith is a certified English translation of French priority application No. 0308865.

Respectfully submitted,

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UNITED STATES PATENT AND TRADEMARK OFFICE

I, Charles Edward SITCH BA,

Managing Director of RWS Group Ltd UK Translation Division, of Europa House, Marsham Way, Gerrards Cross, Buckinghamshire, England declare;

1. That I am a citizen of the United Kingdom of Great Britain and Northern Ireland.

2. That the translator responsible for the attached translation is well acquainted with the French and English languages.

3. That the attached is, to the best of RWS Group Ltd knowledge and belief, a true translation into the English language of the accompanying copy of the specification filed with the application for a patent in France on July 21, 2003 under the number 03/08,865 and the official certificate attached thereto.

4. That I believe that all statements made herein of my own knowledge are true and that all statements made on information and belief are true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the patent application in the United States of America or any patent issuing thereon.

For and on behalf of RWS Group Ltd

The 12th day of November 2007

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2 NATURE OF THE APPLICATION	Tick one of the 4 following boxes	
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3 TITLE OF THE INVENTION (200 characters or spaces maximum)

Stacked structure, and production method thereof

4 PRIORITY DECLARATION OR APPLICATION FOR THE BENEFIT OF THE FILING DATE OF A PRIOR FRENCH APPLICATION	
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Law no. 78-17 of 6 January 1978 relating to data processing, files and civil liberties applies to the answers given in this form.
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The general field of the invention is that of wafer level fabrication of microstructures, for example by means of micromachining or chemical processing techniques used in microelectronics (deposition and etching of layers, photolithography and so on).

The invention relates more particularly to certain microstructures of the micro-electro-mechanical system (MEMS) type, such as various sensors and actuators, which are obtained by freeing mobile portions (for example membranes or seismic masses).

To obtain such microstructures, the starting material may be of the silicon-on-insulator (SOI) type, for example, which usually comprises a surface layer of silicon and an underlying buried layer of silicon oxide SiO_2.

There are several ways to fabricate the SOI material. See, for example, "Semiconductor Wafer Bonding", Q.Y. Tong and U. Goesele, Science and Technology, ECS Series, John Wiley, New Jersey 1999. However, most SOI materials are nowadays fabricated by the molecular bonding technique. For example, two silicon plates are bonded together by the molecular bonding technique, at least one of the two plates having a surface layer of silicon oxide. The silicon oxide layer is usually produced by thermal oxidation. One of the two plates is then thinned. An SOI type structure is obtained in this way.

Several techniques for obtaining a thin layer may be used (in the context of the present invention, a layer is regarded as "thin" if its thickness is less than a few tens of microns). For example, a first technique is thinning (mechanical thinning by planing and/or smoothing, and/or chemical thinning, and/or mechanical-chemical thinning). A second technique uses fracture in a fragile area created at a certain depth in one of the two

plates, prior to said molecular bonding, for example by implanting one or more gaseous species; the patent application FR-2 681 472 discloses a method of the above kind, which at present is known as the "Smart-Cut®" method (see, for example "The Generic Nature of the Smart-Cut® Process for Thin-Film Transfer", B. Aspar et al., Journal of Electronic Materials, Vol. 30, N° 7, 2001). These methods are very suitable for obtaining thin surface layers of silicon, usually less than 2 μm thick.

It is possible to produce mobile or deformable mechanical structures from this SOI material, for example by machining the top silicon film and freeing the structure by chemically etching the whole or a portion of the underlying oxide; for example, the mechanical structure is created by plasma etching the thin surface layer of silicon and chemically etching the silicon oxide layer using hydrofluoric acid (HF).

In the context of the present invention, a layer forming part of a stacked structure is referred to as a "sacrificial" layer when it can be eliminated subsequently, for example during use of the stacked structure to fabricate a component having a mobile or deformable portion. The material constituting a sacrificial layer is therefore different, from the chemical or crystallographic point of view, from the material constituting the "non-sacrificial" layers, i.e. the layers intended to remain after eliminating the sacrificial layer. For example, if the stacked structure is made from an SOI material, the silicon oxide layer serves as a "sacrificial layer" and the silicon layers serve as "non-sacrificial layers".

This process is relatively simple to use and produces a variety of microstructures.

Pressure sensors of high quality may be produced in

this way, for example.

The accelerometer disclosed in the patent FR 2 558 263 may be cited as another example of this kind of microstructure and comprises, within a thin layer, a first portion cut out from the thin layer and a second portion consisting of the remainder of the thin layer, the first portion being connected to the second by means of flexible beams allowing the first or "sensitive" portion to move with a certain amplitude in the plane of the thin layer. This device is used to measure acceleration of any system to which it is attached by means of a variation in electrical capacitance caused by said movement.

Other detailed examples of such microstructures can be found in "SOI 'SIMOX'; from bulk to surface micromachining, a new age for silicon sensors and actuators", B. Diem et al., Sensors and Actuators, Vol. A 46 - 47, pages 8 to 16 (1995).

However, fabrication of such microstructures runs up against the following problem. During the production of the structure, and in particular at the time of drying the rinsing liquid after chemical etching with hydrofluoric acid, capillary forces between the surfaces and the liquid are very high and lead to partial or total sticking of the freed structures; another cause of sticking is a solid deposit which can be produced by said drying. In the case of the accelerometer described above, for example, this leads to the beams sticking to the substrate constituting the bottom of the cavity containing the device, which obviously prevents the beams from moving as intended in response to acceleration of the system.

The SOI structure fabrication techniques referred to above lead to interfaces between the surface layer of silicon and the buried oxide, and between the buried

oxide and the substrate that are not particularly "rough". This "sticking problem" is aggravated in that nowadays SOI structures are produced with very smooth interfaces; the thinner the oxide film, and the larger the structures to be freed, the greater the problem.

In order to avoid these problems of unwanted sticking, it is necessary to take important precautions, which make the freeing process complex, costly and difficult to control. Moreover, for reasons of reliability, such unwanted sticking of facing faces within MEMS components after the components go into service has to be prevented.

A first prior art means of preventing such sticking consists in reducing the bonding energy of the freed layer and the substrate. However, these techniques employ methods of chemical preparation of the surfaces that are incompatible with the high temperatures usually required for subsequent MEMS fabrication steps. For more details, see "Suppression of Stiction in MEMS", C.H. Mastrangelo, Proceedings of the Materials Research Society Seminar, Vol. 605, 2000.

A second prior art way to prevent this sticking is to make the effective area of contact small when these two surfaces move toward each other.

A method of this kind is disclosed in the patent FR 9 508 882. It consists in holding the freed layer and the substrate at a distance by etching the intermediate sacrificial layer to create abutments on each of the facing faces of the freed layer and the substrate.

Another such method is described in "Surface Roughness Modification of Interfacial Contacts in Polysilicon Microstructures", R.L. Alley et al., Proceedings of the 7th International Conference on Semiconductor Detectors and Actuators). That paper proposes a method of producing partially mobile

components including steps leading to a component whose facing free faces have a "roughness" adapted to prevent unwanted sticking between said faces (see the paper for a statistical definition of "roughness"; for example, roughness may be measured using an atomic force microscope scanning areas 1 µm × 1 µm, for example). During the step of chemical freeing of the structure, this method roughens the surfaces concerned in order for the effective area of contact to be limited to the summits of the asperities of those surfaces. The paper by R.L. Alley et al. is essentially concerned with assessing how the sticking force decreases when the roughness increases.

The method described in the above paper has the drawback that it cannot be used to produce certain types of components. In particular, the method provides for the deposition of a surface film on the substrate of the stacked structure; the person skilled in the art knows that this deposition is not always possible, for example depending on the materials concerned. For example, this method cannot produce a monocrystalline surface film to be freed if the material of the sacrificial layer is amorphous; nor can it produce a monocrystalline film, for example of silicon, on a sacrificial layer of a polymer material, because of the incompatibility of the temperature for depositing the silicon film and the temperatures that a polymer is usually able to withstand.

The present invention therefore relates to a method of fabricating a stacked structure, where necessary of large size, and where applicable over the whole of the surface of a wafer having a diameter of 200 mm, for example, enabling subsequent production of any MEMS type component without sticking of mobile or deformable mechanical structures. The method must be applicable regardless of the characteristics of said components, in

particular their size or the materials used, especially if the surface layer that has to be (at least partly) freed is monocrystalline or cannot be simply deposited onto the required stacked structure.

A first aspect of the invention therefore proposes a method of fabricating a stacked structure, said method being noteworthy in that it comprises the following steps:

a) a first plate and a second plate are selected such that at least one of said first and second plates has a structured surface, at least in part,

b) a sacrificial layer is produced on at least a portion of the surface of the first plate and/or the surface of the second plate, and

c) the two plates are bonded together.

Thus using the method of the invention produces a stacked structure comprising a sacrificial layer between two substrates and in which at least one of the two substrates is such that at least a portion of its surface in contact with said sacrificial layer is "structured". In the context of the invention, a surface is regarded as "structured" when it is essentially incapable of sticking to a predetermined other substrate. For example, a surface may be structured because of the physical-chemical nature of that surface or because of a coating applied to that surface; a surface may equally be structured because of a roughness exceeding a predetermined threshold, for example equal to approximately 0.2 nm RMS.

Starting with the stacked structure obtained in this way, a portion of the intermediate sacrificial layer between the two plates may be eliminated, for example, to obtain two facing surfaces at least one of which is appropriately structured. This prevents the two surfaces sticking together following movement of the two

substrates toward each other.

Note that, according to the invention, the structured surfaces are produced before or during fabrication of the stacked structure, and therefore independently of the fabrication of an MEMS type component.

Thanks to the invention, any set of materials that are subsequently useful in the production of an MEMS component may advantageously be selected to constitute the stacked structure. For example, a stack could be produced comprising a thin layer of silicon on a sacrificial layer of polymer or a thin layer of monocrystalline silicon on a sacrificial layer of silicon oxide. Note also that the method of the invention does not limit the lateral dimensions of the stacked structure obtained.

According to particular features of the invention, the free surface of a sacrificial layer or, where appropriate, of both sacrificial layers and/or, where appropriate, the free surface of one of said plates is smoothed before said step c).

These features facilitate subsequent bonding (step c)), which may be molecular bonding, for example, or bonding by means of a sacrificial bonding agent, i.e. a bonding agent that can be eliminated subsequently, for example during use of said stacked structure to fabricate a component comprising a mobile or deformable portion. Moreover, the bonding of the step c) can be "assisted" by mechanical means, for example, and/or by plasma and/or heat treatment, these operations being carried out during or after bonding, in a special atmosphere or in the ordinary atmosphere.

Thanks to these features, the diverse interfaces may in particular be consolidated and/or rendered compatible with future MEMS component production steps.

Two rough surfaces that would not bond to each other spontaneously may also be made to bond in this way.

According to further particular features of the invention, at least one of the two plates is thinned after the step c).

Thanks to these features, portions of an MEMS type component that become mobile after eliminating the sacrificial layer in contact therewith could be produced in the thin film obtained in this way, for example.

The two plates and the sacrificial layer may of course be either simple or composite, i.e. formed themselves of a stack of layers of diverse materials. The stacked structure obtained in this way may advantageously be of the SOI type.

For example, the first plate, and likewise the second plate, may be made of silicon, a semiconductor other than silicon, for example SiC, GaN or InP, or a non-semiconductor material, such as $LiNbO_3$, $LiTaO_3$, glass, fused silica or a superconductor material. The first plate, and likewise the second plate, may equally be any combination of the above materials, in particular a monocrystalline Si/polycrystalline Si stack, SiC/Si stack, InP/Si stack, monocrystalline SiC/polycrystalline SiC stack or SiC/SiO_2/polycrystalline SiC stack. The material constituting the sacrificial layer produced on the first plate and/or the material constituting the sacrificial layer produced on the second plate may be silicon oxide, for example, or a polymer material.

According to particular features, at least one of said plates initially has a surface layer. In particular, this surface layer may have the effect of structuring the surface of the plate on which it rests because of the physical-chemical nature of that surface layer.

A second aspect of the invention provides diverse stacked structures.

Firstly, the invention provides a stacked structure fabricated by any of the methods succinctly described hereinabove.

Secondly, the invention provides a stacked structure that is noteworthy in that it comprises a sacrificial layer between a first substrate and a second substrate and at least one of said first and second substrates has a surface that is structured, at least in part.

Of course, the two substrates and the sacrificial layer may be either simple or composite, i.e. formed themselves of a stack of layers of diverse materials. The stacked structure obtained in this way may be in particular of the SOI type.

For example, the first substrate, and likewise the second substrate, may be made of silicon, a semiconductor other than silicon, for example SiC, GaN or InP, or a non-semiconductor material, such as $LiNbO_3$, $LiTaO_3$, glass, fused silica or a superconductor material. The first substrate, and likewise the second substrate, may equally be any combination of the above materials, in particular a monocrystalline Si/polycrystalline Si stack, an SiC/Si stack, an InP/Si stack, a monocrystalline SiC/polycrystalline SiC stack, or an SiC/SiO_2/polycrystalline SiC stack. The material constituting the sacrificial layer may be silicon oxide, for example, or a polymer material.

According to other particular features of the invention, at least one of the two substrates is a thin layer.

The advantages offered by the above materials are essentially the same as those offered by the corresponding fabrication methods.

Other aspects and advantages of the invention will become apparent on reading the following detailed description of particular embodiments provided by way of

nonlimiting example. The description refers to the appended drawings, in which:

- figure 1 represents a silicon plate prior to implementation of the invention,
- figure 2 shows the same silicon plate after application of a first step of one embodiment of a fabrication method of the invention,
- figure 3 represents a second step of that method,
- figure 4 represents a third step of that method,
- figure 5 represents a fourth step of that method, and
- figure 6 represents a fifth step of that method.

The process starts with a standard silicon plate 1 whose surface 2 has a roughness r_2 which is usually of the order of 0.1 nm (figure 1).

The surface 2 of the plate 1 is then "structured", for example by creating a roughness r'_2 at the surface 2 that is preferably in the range from 0.2 nm to a few micrometers (figure 2). The roughness selected depends, among other things, on the thickness of the intermediate sacrificial layer, the geometrical parameters of the future component with mobile portions, and the stresses in the surface film, for example. The person skilled in the art will know how to determine the roughness to be used to prevent any unwanted sticking within the component.

To produce this roughness of the silicon surface, one or more etching steps may be effected, for example, using an RCA SC1 type mixture (H_2O: NH_4OH: H_2O_2 6:1:1 at 80°C), and/or other wet chemical etching processes (for example using a solution of TMAH or KOH), and/or dry etching processes (such as reactive or non-reactive ion sputtering). Of the techniques for producing this roughness, the following in particular may be cited:

- the technique of producing "black" silicon, as described for example in the paper "Plasma Surface

Texturization for Multicrystalline Silicon Solar Cells", M. Schnell, IEEE, XXVIIIth Photovoltaic Conference,

- "mechanical" techniques, for example sand-blasting or grinding,

- techniques involving "fracture" in crystalline materials leaving rough substrates after fracture, as used in the Smart-Cut® process (involving implanting species and a fracture) or in the CANON Eltran® process (involving obtaining porous silicon and a fracture in the porous region), for example,

- chemical etching techniques well known to the person skilled in the art for producing porous materials, for example those applied to silicon, and

- deposition techniques, in particular deposition of silicon nitride Si_3N_4 by the PECVD process (note that a PECVD deposit is rougher than an LPCVD deposit).

During a second step, a sacrificial layer 3 is produced on the surface of the plate 1 (figure 3).

The layer 3 may be of silicon oxide, for example. In this case, it may be produced by thermal oxidation in a wet or dry atmosphere or by deposition (LPCVD, PECVD or any other appropriate deposition process). The roughness r_4 of the surface 4 of the layer 3 may be of the same order of magnitude as the initial roughness of the plate 1, or higher (it is known in the art to increase the roughness by depositing successive films, the roughness increasing with the number of films deposited and their thickness), or lower, for example as a result of depositing a smoothing oxide (not shown) at a low temperature, flow of which on the surface may be brought about by appropriate heat treatment, for example.

However, in certain cases, it may be necessary to modify the roughness of the surface 4 of the layer 3 to facilitate the subsequent bonding step producing the stacked structure of the invention. To this end, a

slightly lower roughness r'_4 may be produced, for example by carrying out a surface smoothing operation during a third step (figure 4), for example by light mechanical-chemical polishing and/or heat treatment in a special atmosphere and/or depositing a smoothing layer (not shown).

During a fourth step (figure 5), a second plate 5, for example of polycrystalline silicon (which may have a surface layer 9 of another material, for example monocrystalline silicon or SiC), is bonded to the layer 3, preferably by molecular bonding. Bonding may equally be effected by means of a sacrificial type of bonding agent, i.e. a bonding agent that may be selectively removed, for example a photosensitive polymer.

In the case of a surface roughness incompatible with spontaneous molecular bonding of the parts to be assembled to form the stacked structure of the invention, "bonding assistance" may advantageously be used, firstly by placing the surfaces in contact, where applicable after applying plasma treatment to the surfaces, and then by applying mechanical stress and/or heat treatment to the stacked structure in a special atmosphere or in the ordinary atmosphere.

Heat treatment applied during or after bonding additionally consolidates the various interfaces and/or renders them compatible with future MEMS component production steps.

Finally, during an optional fifth step, at least one of the two plates 1 and/or 5 (the plate 5 in figure 6) may be thinned to obtain a stacked structure 100, for example of the SOI type. Thinning may be effected by any of the prior art methods, such as those described in the introduction.

Note that it is perfectly feasible, in a variant of the invention, to place the steps of the method of

producing the microstructure, for example the etching of areas in the sacrificial layer in contact with the mobile portions, in the middle of the steps that have just been described, for example before the bonding step. In this case, the mobile portions may also be defined in the plate that is subsequently thinned before the bonding step; after bonding and thinning of the plate comprising the mobile portions, heat treatment may be applied to strengthen the bonding interface of the stacked structure with no pressure stresses (said areas underlying the mobile portions giving onto the surface).

The embodiment described above may be modified or generalized in various ways. In particular, the method may relate to the whole or only a portion of the surface of at least one of the plates or one of the films treated. For example, a predetermined structure may be obtained in a localized area using a lithographic process.

As mentioned above, a given surface may be "structured" without necessarily roughening it.

For example, if the other substrate is of silicon, the surface to be structured may be treated by nitriding.

Another example of this is depositing on the surface to be structured a layer of an "anti-stick" material, i.e. a material whose physical-chemical nature is such that it opposes subsequent unwanted sticking (the creation of roughness, surface treatment or production of an "anti-stick" layer techniques may be combined, of course).

Thus a surface layer 6 (not shown), for example of Si_3N_4, may initially be deposited onto a first plate 1 with any roughness. A roughness r'_2 may then be created on the surface 2 of that surface layer 6, as explained above, for example by conforming a rough surface by deposition. However, instead of or in addition to this

creation of roughness, the surface of the surface layer 6 may also be prepared to render it incompatible with unwanted sticking to the substrate intended to face the surface layer 6; using prior art methods, for example, the surface of a surface layer 6 of Si_3N_4 may be rendered hydrophobic; materials other than silicon nitride Si_3N_4 may be used here, such as diamond, Al_2O_3 or ZrO_2.

The sacrificial layer 3 is then deposited onto the surface layer 6, being adapted, as explained above, for bonding, for example molecular bonding, to the plate 5 (which in this embodiment is of silicon), where applicable after a step of leveling by means of mechanical-chemical polishing or heat treatment. If necessary, bonding may be "assisted" in the manner explained above. During the production of the mobile structure component, selective etching of the layer 3 frees the structured surface of the surface layer 6: during this selective etching, using hydrofluoric acid, for example, the material used for the sacrificial layer 3, for example silicon oxide SiO_2, is etched, whereas that used for the surface layer 6, for example silicon nitride Si_3N_4, is not.

Embodiments are described above in which only the surface 2 of the first plate 1 is structured; however, it is clear that, within the context of the invention, it is feasible to structure the surface 7 (not shown) of the second plate 5 as well or instead (the latter plate comprising a surface layer 9, where appropriate, as described above).

Moreover, in the embodiments described above, a sacrificial layer 3 is produced only on the first plate 1; however, it is clear that, in the context of the invention, a sacrificial layer 8 (not shown) may instead or in addition be produced on the second plate 5. The two plates are then bonded as described above, where

appropriate after smoothing the surface 10 (not shown) of the sacrificial layer 8.

It is clear that a non-continuous sacrificial layer may be obtained, for example by localized deposition or by etching; this enables areas already opened up to be defined in the stacked structure.

The methods described above may be applied to any structure including a thin layer adhering to a buried layer, for example of silicon oxide, to be sacrificed locally, the latter resting on a support that may be of a material other than silicon. Depending on the requirements of the intended application, the person skilled in the art will be able to combine the methods described above to produce specific stacked structures according to the invention.

Note, finally, that the surface structuring required by the invention is not necessarily homogeneous over the whole of the surfaces concerned: for example, in certain applications it may be advantageous to produce a surface whose structuring is divided at random or in accordance with a particular distribution over the surface of one of the plates.

CLAIMS

1. Method of fabricating a stacked structure, characterized in that it comprises the following steps:

a) a first plate (1) and a second plate (5) are selected, and at least one of said first (1) and second (5) plates is structured so that it has a "structured" surface (2; 7), at least in part,

b) a sacrificial layer (3; 8) is produced on at least a portion of the surface (2) of the first plate (1) and/or the surface (7) of the second plate (5), and

c) the two plates (1; 5) are bonded together.

2. Method according to claim 1, characterized in that said surface (2; 7) is structured by reason of its physical-chemical nature.

3. Method according to claim 1, characterized in that said surface (2; 7) is structured by reason of a roughness (r'_2, r'_7) greater than a predetermined threshold.

4. Method according to claim 3, characterized in that said predetermined threshold is equal to approximately 0.2 nm RMS.

5. Method according to any one of the preceding claims, characterized in that at least one of said plates (1; 5) initially has a surface layer (6; 9).

6. Method according to claim 5, characterized in that said surface layer (6; 9) is monocrystalline.

7. Method according to claim 5 or claim 6, characterized in that said surface layer (6; 9) is of silicon.

8. Method according to claim 5, characterized in that said surface layer (6; 9) has the effect of structuring said surface (2; 7) because of the physical-chemical nature of that surface layer (6; 9).

9. Method according to claim 8, characterized in that said surface layer (6; 9) is of silicon nitride.

10. Method according to any one of the preceding claims, characterized in that the free surface (4; 10) of the sacrificial layer (3; 8) and/or the free surface of one of said plates (1; 5) is smoothed before said step c).

11. Method according to any one of claims 1 to 10, characterized in that the bonding of said step c) is molecular bonding.

12. Method according to any one of claims 1 to 10, characterized in that the bonding of said step c) uses a sacrificial bonding agent.

13. Method according to any one of the preceding claims, characterized in that the bonding of said step c) is assisted by mechanical means and/or plasma treatment and/or thermal treatment, these operations being carried out before or during bonding, in a special atmosphere or in the open air.

14. Method according to any one of the preceding claims, characterized in that at least one of the two plates (1) and/or (5) is thinned after said step c).

15. Method according to any one of the preceding claims, characterized in that the massive portion of at least one of the plates (1; 5) consists of a semiconductor material.

16. Method according to claim 15, characterized in that said massive portion consists of silicon.

17. Method according to any one of claims 1 to 16, characterized in that the sacrificial layer (3; 8) consists of silicon oxide.

18. Method according to any one of claims 1 to 16, characterized in that said material constituting the sacrificial layer (3; 8) is a polymer.

19. Stacked structure (100), characterized in that it is fabricated by means of a method according to any one of claims 1 to 18.

20. Stacked structure (100), characterized in that it comprises a sacrificial layer (3, 8) between a first substrate (1) and a second substrate (5), and in that at least one of said first (1) and second (5) substrates has a "structured" surface (2; 7), at least in part.

21. Stacked structure according to claim 20, characterized in that said surface (2; 7) is structured by reason of its physical-chemical nature.

22. Stacked structure according to claim 20, characterized in that said structuring of the surface (2; 7) consists in a roughness (r'_2, r'_7) greater than a predetermined threshold.

23. Stacked structure according to claim 22, characterized in that said predetermined threshold is equal to approximately 0.2 nm.

24. Stacked structure according to any one of claims 20 to 23, characterized in that at least one of said substrates (1; 5) has a surface layer (6; 9).

25. Stacked structure according to claim 24, characterized in that said surface layer (6; 9) is monocrystalline.

26. Stacked structure according to claim 24 or claim 25, characterized in that said surface layer (6; 9) consists of silicon.

27. Stacked structure according to claim 24, characterized in that said surface layer (6; 9) has the effect of structuring said surface (2; 7) by reason of the physical-chemical nature of that surface layer (6; 9).

28. Stacked structure according to claim 27, characterized in that said surface layer (6; 9) consists of silicon nitride.

29. Stacked structure according to any one of claims 20 to 28, characterized in that the massive portion of at least one of the substrates (1; 5) consists

20. Stacked structure (100), characterized in that it comprises a sacrificial layer (3, 8) between a first substrate (1) and a second substrate (5), and in that at least one of said first (1) and (5) substrates has a "structured" surface (2; 7), at least in part.

21. Stacked structure according to claim 20, characterized in that said surface (2; 7) is structured by reason of its physical-chemical nature.

22. Stacked structure according to claim 20, characterized in that said structuring of the surface (2; 7) consists in a roughness (r'_2, r'_7) greater than a predetermined threshold.

23. Stacked structure according to claim 22, characterized in that said predetermined threshold is equal to approximately 0.2 nm RMS.

24. Stacked structure according to any one of claims 20 to 23, characterized in that at least one of said substrates (1; 5) has a surface layer (6; 9).

25. Stacked structure according to claim 24, characterized in that said surface layer (6; 9) is monocrystalline.

26. Stacked structure according to claim 24 or claim 25, characterized in that said surface layer (6; 9) consists of silicon.

27. Stacked structure according to claim 24, characterized in that said surface layer (6; 9) has the effect of structuring said surface (2; 7) by reason of the physical-chemical nature of that surface layer (6; 9).

28. Stacked structure according to claim 27, characterized in that said surface layer (6; 9) consists of silicon nitride.

29. Stacked structure according to any one of claims 20 to 28, characterized in that the massive portion of at least one of the substrates (1; 5) consists

of a semiconductor material.

30. Stacked structure according to claim 29, characterized in that said massive portion consists of silicon.

31. Stacked structure according to any one of claims 20 to 30, characterized in that the sacrificial layer (3, 8) consists of silicon oxide.

32. Stacked structure according to any one of claims 20 to 30, characterized in that the material constituting the sacrificial layer (3, 8) is a polymer.

33. Stacked structure according to any one of claims 20 to 32, characterized in that at least one of said substrates (1; 5) is a thin layer.

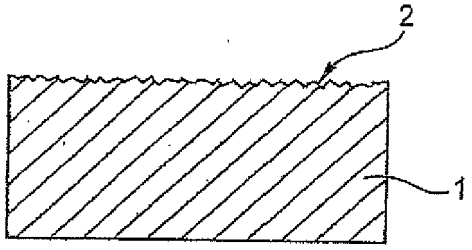

Fig.1

Fig.2

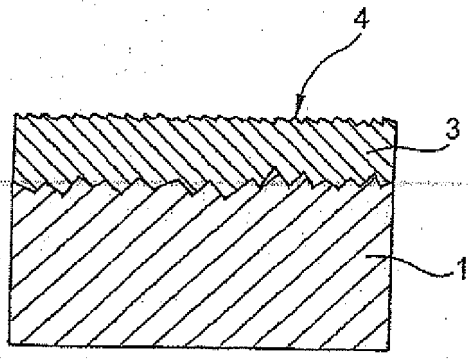

Fig.3

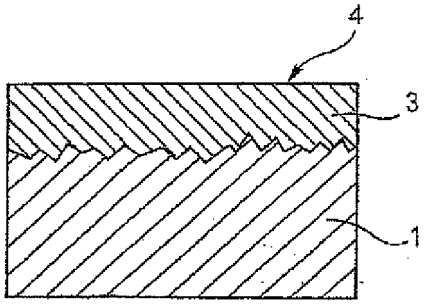

Fig.4

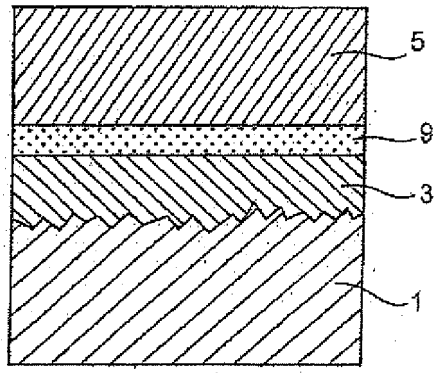

Fig.5

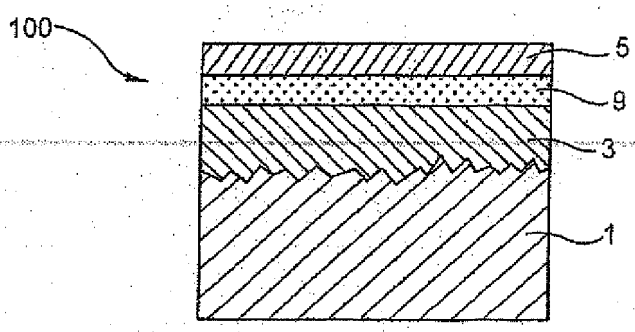

Fig.6

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DESIGNATION OF THE INVENTOR(S) Page No. . 1 . / . 1 **INV**
(if the applicants are not the inventor or the inventors)

This form is to be filled in legibly in black ink

DB 113 W / 270501

Your file references *(optional)*	BIF116044/FR
NATIONAL REGISTRATION No.	03/08,865

TITLE OF THE INVENTION (200 characters or spaces maximum)

Stacked structure, and production method thereof

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If there are more than 3 inventors, use a number of forms. Indicate top right the page No. followed by the number of pages.

DATE AND SIGNATURE(S) OF THE APPLICANT(S) OR OF THE REPRESENTATIVE (Name and capacity of the signatory)

21 July 2003
François LEPPELETIER-BEAUFOND No. 92.1151
SANTARELLI

[illegible signature]